

EL928737444US

Atty. Docket #: S-99/37

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

INTERNATIONAL APPL. NO.: PCT/EP00/08652 :

INTERNATIONAL FILING DATE: -09/05/2000-:

APPLICANT: PIERRE DOURNEL :

SERIAL NO: (To be assigned) : **ART UNIT:**

FILED: -HEREWITH- : **EXAMINER:**

FOR: "PROCESS FOR THE MANUFACTURE
OF
POLYMERIC FOAMS" :

Commissioner for Patents
Box PCT
Washington, D.C. 20231

"Express Mail" No.: EL928737444

Date: -MARCH 11, 2002-

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- J. Lynn Ferry -
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**TRANSMITTAL OF APPLICATION PAPERS
TO U.S. DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. §371
(37 CFR 1.494 OR 1.495)**

This Transmittal Letter is based upon PTO Form 1390 (as revised in May, 1993).

The above-identified applicant(s) (jointly with their assignee) have filed an International Application under the P.C.T. and hereby submit(s) to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. §371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. §371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. §371 [f]) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination (IPE) was made to the appropriate Authority (IPEA) within the time period required.
5. ☒ A copy of the International Application as filed (35 U.S.C. §371 [c][2]) --
 - a. ☒ is transmitted herewith (required when not transmitted by International Bureau).
 - b. ☒ has been transmitted by the International Bureau. See WIPO Publication WO 01/19905.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A (verified) translation of the International Application into the English language is enclosed.
7. ☐ Amendments to the (specification and) claims of the International Application under PCT Article 19 (35 U.S.C. 371[c][3])
 - a. ☐ are transmitted herewith (required if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
 - e. ☐ will be submitted with the appropriate surcharge.
8. ☐ A translation of the amendments to the claims (and/or the specification) under PCT Article 19 (35 U.S.C. §371[c][3]) is enclosed or will be submitted with the appropriate surcharge.

9. ☒ An oath or declaration/power of attorney of the inventor(s) (35 U.S.C. §371(c)[4]) will follow.
☐ and is attached to the translation of (or a copy of) the International Application.
☐ and is attached to the substitute specification.

10. ☐ A translation of at least the Annexes to the IPE Report under PCT Article 36 (35 U.S.C. §371(c)[5]) is enclosed.

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 is enclosed.
12. ☒ An Assignment for recording and a separate cover sheet in compliance with 37 CFR 3.28 and 3.31 will follow.
13. ☒ A FIRST preliminary amendment is enclosed.
A SECOND or SUBSEQUENT preliminary amendment is enclosed.
14. ☐ A substitute specification (including claims, abstract, drawing) is enclosed.
15. ☐ A change of power of attorney and/or address letter is enclosed.
16. ☒ Other items of information:

- ☒ This application is being filed pursuant to 37 CFR 1.494(c) or 1.495(c), and any missing parts will be filed before expiration of--

☐ 22 months from the priority date under 37 CFR 1.494(c), or

☒ 32 months from the priority date under 37 CFR 1.495(c).

- ☒ The undersigned attorney is authorized by the International applicant and by the inventors to enter the National Phase pursuant to 37 CFR 1.494(c) or 1.495(c).

The following additional information relates to the International Application:

International Application No. PCT/EP00/08652

S-99/37

- ☒ Receiving Office: EPO
- ☒ IPEA (if filing under 37 CFR 1.495): EPO
- ☒ Priority Claim(s) (35 USC §§ 119, 365):
 European Appln. 99870184.1 filed -September 10, 1999-(enclosed).
- ☒ A copy of the International Search Report is
 - ☐ enclosed.
 - ☒ attached to the copy of the International Application.
- ☒ A copy of the Receiving Office Request Form is enclosed.
- ☒ Form PTO/SB/05 (1) sheet
- ☒ Form PCT/IPEA/409 (9) sheets (in FR)
- ☒ Claims Amended according to Article 34 PCT (1-11)

The fee calculation is set forth on the next page of this Transmittal Letter.

FEE CALCULATION SHEET

☒ A check in payment of the filing fee, calculated as follows, is attached (37 CFR 1.492).

Basic Fee..... \$ 890.00

Total Number of claims in
excess of (20) times \$18..... -0-

Number of independent claims
in excess of (3) times \$84..... -0-

Fee for multiple dependent
claims \$280..... -0-

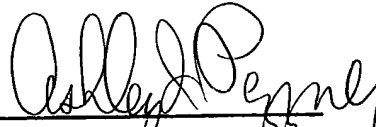
TOTAL FILING FEE... \$ 890.00

Kindly send us the official filing receipt.

The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Deposit Account No. 03-2775. This is a "general authorization" under 37 CFR 1.25(b), except that no automatic debit of the issue upon allowance is authorized. An additional copy of this page is attached.

Respectfully submitted,

By


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AIP/ jlf (5129*53)

Enclosures

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ATTORNEY DOCKET NO.: S-00/37 (5129*53)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: PIERRE DOURNEL)	
)	
SERIAL NO. TO BE ASSIGNED)	ART UNIT: TO BE ASSIGNED
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FILED: HEREWITH)	EXAMINER: TO BE ASSIGNED
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FOR: PROCESS FOR THE MANUFACTURE)	
OF POLYMERIC FOAMS)	
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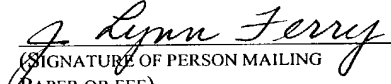
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J. LYNN FERRY
(TYPED OR PRINTED NAME OF
PERSON MAILING PAPER OR FEE)


(SIGNATURE OF PERSON MAILING
PAPER OR FEE)

PRELIMINARY AMENDMENT

Sir:

Prior to fee calculation and examination please amend the above-identified application as follows.

In the Claims

Please cancel claims 1 through 13.

Please add the following news claims:

- 14. A process for the manufacture of a polystyrene closed-cell foam in which a blowing agent comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive is employed.
15. The process according to Claim 14, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is at least 1.5.
16. The process according to Claim 15, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is more than 2.
17. The process according to Claim 14, in which the blowing agent contains more than 60% by weight of a mixture of 1,1-difluoroethane and 1,1,1,2-tetrafluoroethane.
18. The process according to Claim 14, wherein said additive is alcohol.
19. A composition comprising 1,1-difluoroethane and 1,1,1,2-tetrafluoroethane and an alcohol, which composition can be used as blowing agent for the manufacture of polymer-based foams.
20. The composition according to Claim 19, wherein said alcohol is methanol, ethanol, n-propanol or isopropanol.
21. A composition comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and carbon dioxide, wherein the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is greater than 1, which can be used as blowing agent for the manufacture of polymer-based foam.
22. The composition according to Claim 19, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane is at least 1.5.

23. The composition according to Claim 19, containing more than 60% by weight of 1,1-difluoroethane and of 1,1,1,2-tetrafluoroethane.
24. A thermal insulation panel comprising the polystyrene closed-cell foam, obtained using the process according to Claim 14.
25. A thermal insulation panel comprising the polystyrene closed-cell foam, obtained using the process according to Claim 16.
26. A thermal insulation panel comprising the polystyrene closed-cell foam, obtained using the process according to Claim 17.
27. The process according to Claim 14, wherein the polystyrene closed-cell foam contains more than 90% of closed cells.
28. The process according to Claim 27, wherein the thermal conductivity at 10% of the polystyrene closed-cell foam after 90 days storage at room temperature is 27.0 mW/m.K or less.
29. The thermal insulation panel according to Claim 24, wherein the polystyrene closed-cell foam contains more than 90% of closed cells.
30. The thermal insulation panel according to Claim 24, wherein the thermal conductivity at 10% of the polystyrene closed-cell foam after 90 days storage at room temperature is 27.0 mW/m.K or less.
31. The thermal insulation panel according to Claim 29, wherein the thermal conductivity at 10% of the polystyrene closed-cell foam after 90 days storage at room temperature is 27.0 mW/m.K or less. --

REMARKS

Applicant has rewritten claims 1 through 13 as newly added claims 14 through 26 respectively. Support for newly added claims 27 through 31 can be found in the Examples.

Claims 14 through 31 are now in this case. Claims 14, 19 and 21 are the only independent claims.

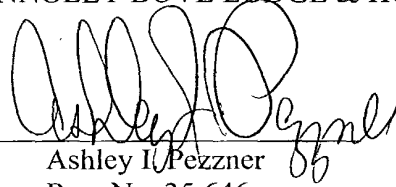
No additional fee is required for the extra claims. If there are any additional fees due in connection with the filing of this Preliminary Amendment, the Commissioner is authorized to charge or credit any overpayment to Deposit Account No. 03-2775.

A prompt and favorable action is solicited.

Respectfully submitted,

CONNOLLY BOVE LODGE & HUTZ LLP

By



Ashley I. Pezzner
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PROCESS
FOR THE
MANUFACTURE
OF
POLYMERIC FOAMS

Pierre Dournel

ENGLISH TRANSLATION
OF
INTERNATIONAL APPLICATION

PCT/EP00/08652 IFD: 09/05/2000

S-99/37 (5129*53)

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Process for the manufacture of polymeric foams

The present invention relates to a process for the manufacture of polymer-based foams, employing a blowing agent and optionally an additive.

In a process for manufacturing polymer-based foams, the choice of blowing agent is a problem of great technical interest since the physical properties of the foam or, when the foam is used, of the manufactured article, especially its compressibility, its dimensional stability, its hygroscopicity, its thermal conductivity, its density, its cellular structure and its surface properties, depend critically on the nature of the blowing agent. In addition, the blowing agent must be compatible with the polymer under the operating conditions. For example, it is desirable for the blowing agent to be soluble, when appropriate, in the polymer melt.

Chlorocarbons, such as methyl chloride have been used as blowing agent. However, this compound has a considerable toxicity.

Chlorofluorocarbons, such as dichlorodifluoromethane (CFC-12), and then hydrochlorofluorocarbons, such as for example mixtures of HCFC-22 (chlorodifluoromethane) with HCFC 142b (1-chloro-1,1-difluoroethane), have also been used as blowing agent. These compounds have to be progressively replaced because they are questioned in the context of the degradation of the stratospheric ozone layer. Global warming is another ecological problem which must also be taken into account.

It has been proposed to use carbon dioxide as single blowing agent. However, the foams produced in this way have a poor thermal insulation capacity, associated with a rapid increase in thermal conductivity over time. What is more, this compound causes problems during processing, due to its high gas pressure.

In the specific case of a process for manufacturing foam panels based on extruded polystyrene, the Patent Application EP-A-543 242 has proposed blowing agents containing 1,1-difluoroethane and ethanol and/or carbon dioxide and/or butane. However, these blowing agents have problems, especially with regard to the thermal conductivity of the panels obtained.

The invention aims to provide a process for obtaining a polymer-based foam having suitable properties, especially as regards, where appropriate, the thermal conductivity of the objects obtained, while meeting the ecological and toxicological requirements.

As a consequence, the invention relates to a process for the manufacture of a polymer-based foam, in which a blowing agent comprising 1,1-difluoroethane (HFC-152a), 1,1,1,2-tetrafluoroethane (HFC-134a) and optionally an additive is employed.

5 Surprisingly, it has been found that the process according to the invention allows easy processing of the polymers in order to obtain polymer-based foams having good physical properties while being environmentally friendly.

In the process according to the invention, the blowing agent often comprises more than 60% by weight of 1,1-difluoroethane and of 1,1,1,2-
10 tetrafluoroethane. Preferably, the blowing agent comprises more than 80% by weight of 1,1-difluoroethane and of 1,1,1,2-tetrafluoroethane. A blowing agent comprising more than 90% by weight of 1,1-difluoroethane and of 1,1,1,2-tetrafluoroethane is most particularly preferred.

In the blowing agent, the weight ratio of 1,1-difluoroethane to 1,1,1,2-
15 tetrafluoroethane is generally greater than 1. Often the ratio is at least 1.5. Preferably, the ratio is more than 2. A ratio of at least 2.3 is most particularly preferred. In general, the ratio is at most 9. More often, the ratio is at most 5. A ratio of at most 4 is preferred. A ratio of at most 3.5 is most particularly preferred.

In the process according to the invention, the blowing agent optionally
20 contains an additive. The additive is preferably selected from alcohols and carbon dioxide. Alcohols are more particularly preferred. Among alcohols that can be used are, for example, aliphatic alcohols having a boiling point from 50°C to 120°C at atmospheric pressure. Methanol, ethanol, n-propanol and isopropanol are preferred. Ethanol is most particularly preferred. The carbon dioxide is preferably
25 used in the liquid state.

The additive content in the blowing agent is generally at most 20% by weight. An additive content of less than 10% by weight is quite suitable. Preferably, the additive content is at most 8% by weight. When the blowing agent contains an additive, the additive content is generally at least 0.1% by weight.
30 More often the content is at least 0.5% by weight, preferably at least 1% by weight.

In the process according to the invention, the blowing agent may essentially consist of 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive. The blowing agent may also consist of 1,1-difluoroethane, 1,1,1,2-
35 tetrafluoroethane and optionally an additive.

The invention also relates to compositions comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive, which can be used as blowing agent in a process for the manufacture of a polymer-based foam. The preferred additives which can be used and which are preferred and the proportions and

contents which can be used and which are preferred in the compositions according to the invention are described above in the context of the use of the compositions according to the invention as blowing agent in the process according to the invention.

5 The techniques for manufacturing a polymer-based foam employing a blowing agent are known. It is preferred to use a foaming extrusion process in which a polymer melt is processed in an extruder, a quantity of blowing agent being added to the melt, and the blend of polymer and blowing agent is extruded in order to obtain a polymer-based foam.

10 The quantity of blowing agent is generally at most 15% by weight of the polymer, preferably at most 10% by weight. The quantity is generally at least 5% by weight, preferably at least 7% by weight.

The process according to the invention can be used for the manufacture of foams based on any polymer known to give foams, such as, for example, the
15 polymers mentioned in ULLMANN, *Encyclopaedia of Technical Chemistry*, 5th edition, Vol. A11, p. 435. The process according to the invention advantageously applies to the manufacture of polyolefin-based foams or polyalkenylaromatic-foams. Preferably, the process according to the invention applies to the manufacture of polystyrene-based foams, preferably with closed cells. Particularly
20 preferably, the process according to the invention applies to the manufacture of polystyrene-based foams by extrusion (XPS), in particular to make thermal insulation panels.

The invention therefore also relates to a thermal insulation panel comprising a polymer-based foam obtained using the process according to the
25 invention.

The examples below are intended to illustrate the invention without, however, limiting it.

Examples 1-3

Polystyrene and 8.5% by weight of the blowing agent with respect to the
30 polystyrene, at an operating pressure of 220 bar, were introduced into a tandem extruder. This blend was extruded in order to obtain a thermal insulation panel. The latter was stored at room temperature for 90 days and its thermal conductivity at 10°C was measured on a thermal conductivity measurement instrument of the FOX200 type sold by LaserComp. The table below shows the results obtained
35 using various blowing agents according to the invention. The HFC-152a, HFC-134a and ethanol contents in the blowing agent are expressed in parts by weight.

Table 1

Example	HFC-152a	HFC-134a	Ethanol	Bulk density (kg/m ³)	10°C/90 day thermal conductivity λ (mW/m.K)
1	70	30	5	40	26.6
2	75	25	5	37	25.9
3	75	25	0	37	27.0

All the foams contained more than 90% closed cells.

Example 4

A polystyrene-based thermal insulation panel was manufactured by extrusion according to the procedure of Examples 1 to 3, employing a blowing agent consisting of 75 parts by weight of HFC-152a, 25 parts by weight of HFC-134a and 5 parts by weight of ethanol, the thermal insulation panel having a thickness of 4 cm and a bulk density of 36.9 kg/m³, with a closed-cell content of 99%. The insulation panel was stored at room temperature and its thermal conductivity at 10°C was measured. After 60 days, the thermal conductivity was 25.2 mW/m.K. After 180 days, the thermal conductivity was 27.1 mW/m.K. After 290 days the thermal conductivity was 27.9 mW/m.K.

The process according to the invention makes it possible to obtain a foam and a thermal insulation panel with a suitable density and good properties as regards thermal conductivity. The thermal conductivity of the foam or of the panel retains very suitable values even after a long storage time at room temperature.

CLAIMS

1 - Process for the manufacture of a polystyrene closed-cell foam in which a blowing agent comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive is employed.

5 2 - Process according to Claim 1, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is at least 1.5.

3 - Process according to Claim 1, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is more than 2.

10 4 - Process according to any one of Claims 1 to 3, in which the blowing agent contains more than 60% by weight of a mixture of 1,1-difluoroethane and 1,1,1,2-tetrafluoroethane.

5 - Process according to any one of Claims 1 to 4, in which the blowing agent contains an alcohol as additive.

15 6 - Composition comprising 1,1-difluoroethane and 1,1,1,2-tetrafluoroethane and an alcohol, which composition can be used as blowing agent for the manufacture of polymer-based foams.

7 - Composition according to Claim 6, in which the alcohol is chosen from methanol, ethanol, n-propanol and isopropanol.

20 8 - Composition comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and carbon dioxide, characterized in that the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane in the blowing agent is greater than 1, which can be used as blowing agent for the manufacture of polymer-based foam.

9 - Composition according to any one of Claims 6 to 8, in which the weight ratio of 1,1-difluoroethane to 1,1,1,2-tetrafluoroethane is at least 1.5.

25 10 - Composition according to any one of Claims 6 to 9, containing more than 60% by weight of 1,1-difluoroethane and of 1,1,1,2-tetrafluoroethane.

11 - Thermal insulation panel, comprising a polystyrene closed-cell foam, obtained using the process according to any one of Claims 1 to 5.

ABSTRACT

Process for the manufacture of polymeric foams

The invention relates to a process for the manufacture of a polymer-based foam, in which a blowing agent comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive is employed.

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- (21) Numéro de la demande internationale: PCT/EP00/08652 (81) États désignés (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
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- (71) Déposant (pour tous les États désignés sauf US): SOLVAY (SOCIÉTÉ ANONYME) [BE/BE]; 33, rue du Prince-Albert, B-1050 Bruxelles (BE).
- (72) Inventeur; et
- (75) Inventeur/Déposant (pour US seulement): DOURNEL, Pierre [FR/BE]; 199, rue du Cornet, B-1040 Bruxelles (BE).

Publiée:

— Avec rapport de recherche internationale.

En ce qui concerne les codes à deux lettres et autres abréviations, se référer aux "Notes explicatives relatives aux codes et abréviations" figurant au début de chaque numéro ordinaire de la Gazette du PCT.

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INTERNATIONAL APPLICATION -with-
Search Report

S-99/37

(5129*53)

WO 01/19905 A1

(54) Title: METHOD FOR MAKING POLYMERIC FOAMS

(54) Titre: PROCÉDE POUR LA FABRICATION DE MOUSSES POLYMERIQUES

(57) Abstract: The invention concerns a method for making a polymeric foam based on polymer which consists in using a swelling agent comprising 1,1-difluoroethane, 1,1,1,2-tetrafluoroethane and optionally an additive.

(57) Abrégé: L'invention concerne un procédé pour la fabrication d'une mousse à base de polymère dans lequel on met en oeuvre un agent gonflant comprenant du 1,1-difluoroéthane, du 1,1,1,2-tétrafluoroéthane et éventuellement un adjuvant.

COMBINED DECLARATION AND POWER OF ATTORNEY	Atty Docket No.
--	-----------------

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name,
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"Process for the manufacture of polymeric foams"

the specification of which

(check one) ☐ is attached hereto.
☐ was filed on as Application and amended through

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above
I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56
I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
<u>99870184.1</u>	<u>European</u>	<u>10/09/1999</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim benefits under Title 35, United States Code, § 119 of any United States provisional application(s) listed below:

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(Application Serial No.)	(Filing Date)

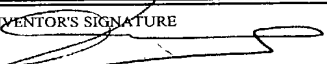
I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application

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(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)
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(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Rudolf E. Hutz, Reg. No. 22,397; Harold Pezzner, Reg. No. 22,112; Richard M. Beck, Reg. No. 22,580; Paul E. Crawford, Reg. No. 24,397; Thomas M. Meshbesh, Reg. No. 25,083; Patricia Smink Rogowski, Reg. No. 33,791; Robert G. McMorrow, Jr., Reg. No. 30,962; Ashley I. Pezzner, Reg. No. 35,646; William E. McShane, Reg. No. 32,707; Mary W. Bourke, Reg. No. 30,982; Gerard M. O'Rourke, Reg. No. 39,794; Allan N. Kutzenco, Reg. No. 38,945; and James M. Olsen, Reg. No. 40,408 all of P.O. Box 2207, Wilmington, Delaware 19899-2007 my attorneys with full power of substitution and revocation.

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DATE			
RESIDENCE		CITIZENSHIP	
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FULL NAME OF THIRD JOINT INVENTOR		INVENTOR'S SIGNATURE	
DATE			
RESIDENCE		CITIZENSHIP	
POST OFFICE ADDRESS			
FULL NAME OF FOURTH JOINT INVENTOR		INVENTOR'S SIGNATURE	
DATE			
RESIDENCE		CITIZENSHIP	
POST OFFICE ADDRESS			
FULL NAME OF FIFTH JOINT INVENTOR		INVENTOR'S SIGNATURE	
DATE			
RESIDENCE		CITIZENSHIP	
POST OFFICE ADDRESS			
FULL NAME OF SIXTH JOINT INVENTOR			
RESIDENCE			
POST OFFICE ADDRESS			